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Cover

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(54) **DRAGLINE BUCKET WITH REMOTE DUMPING AND POSITIONING CAPABILITIES**

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E02F 3/48 (2006.01)

(52) **U.S. Cl.**
USPC **37/396**; 37/395; 37/398

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See application file for complete search history.

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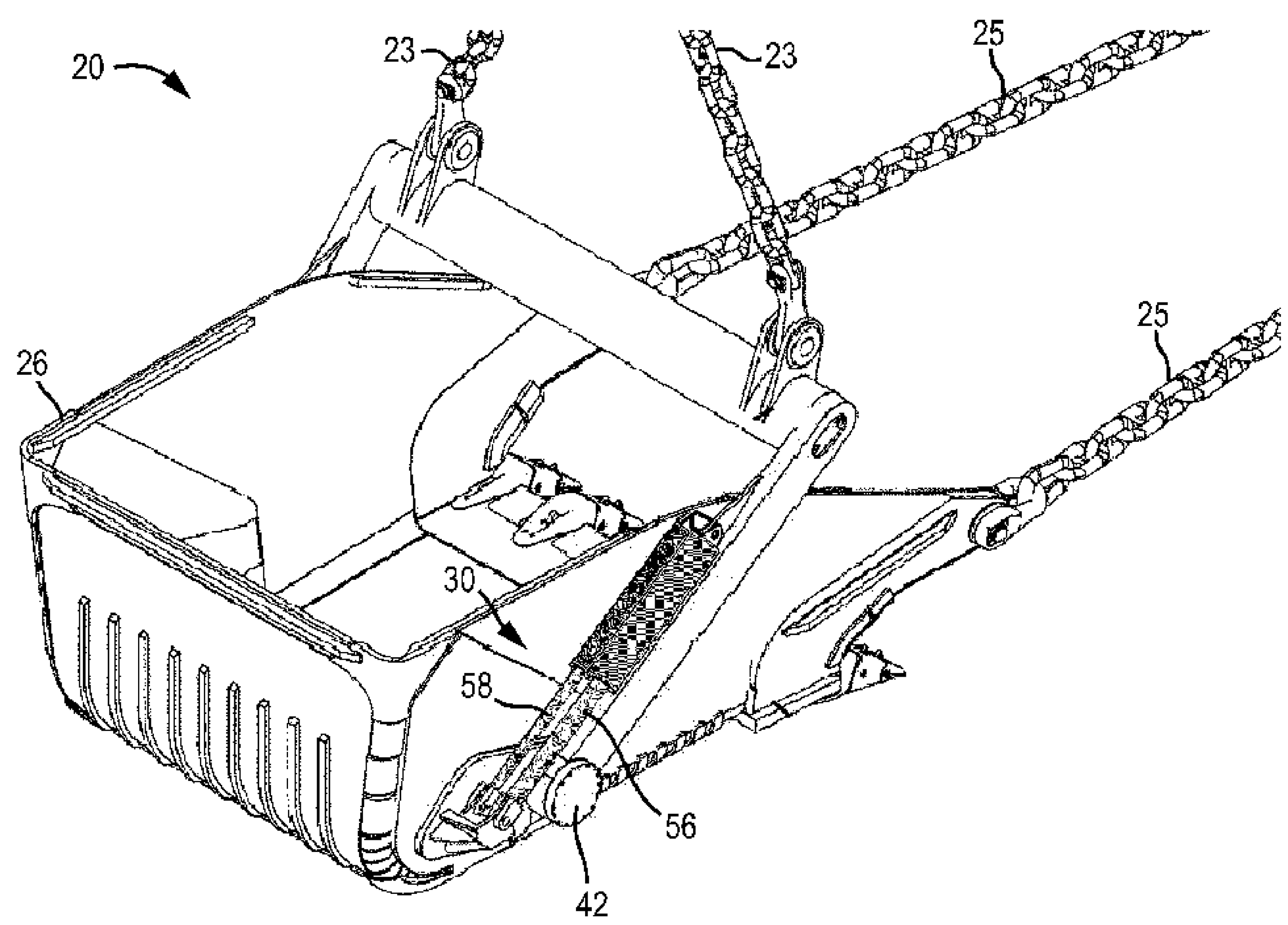
(57) **ABSTRACT**

A dragline bucket includes a main body moveable between a digging orientation and a dumping orientation and a pivotable spreader beam coupled to the main body at a pivot point. The dragline bucket further includes an energy capture mechanism including an actuator coupled to the main body and the pivotable spreader beam and an energy storage mechanism coupled to the actuator.

10 Claims, 6 Drawing Sheets



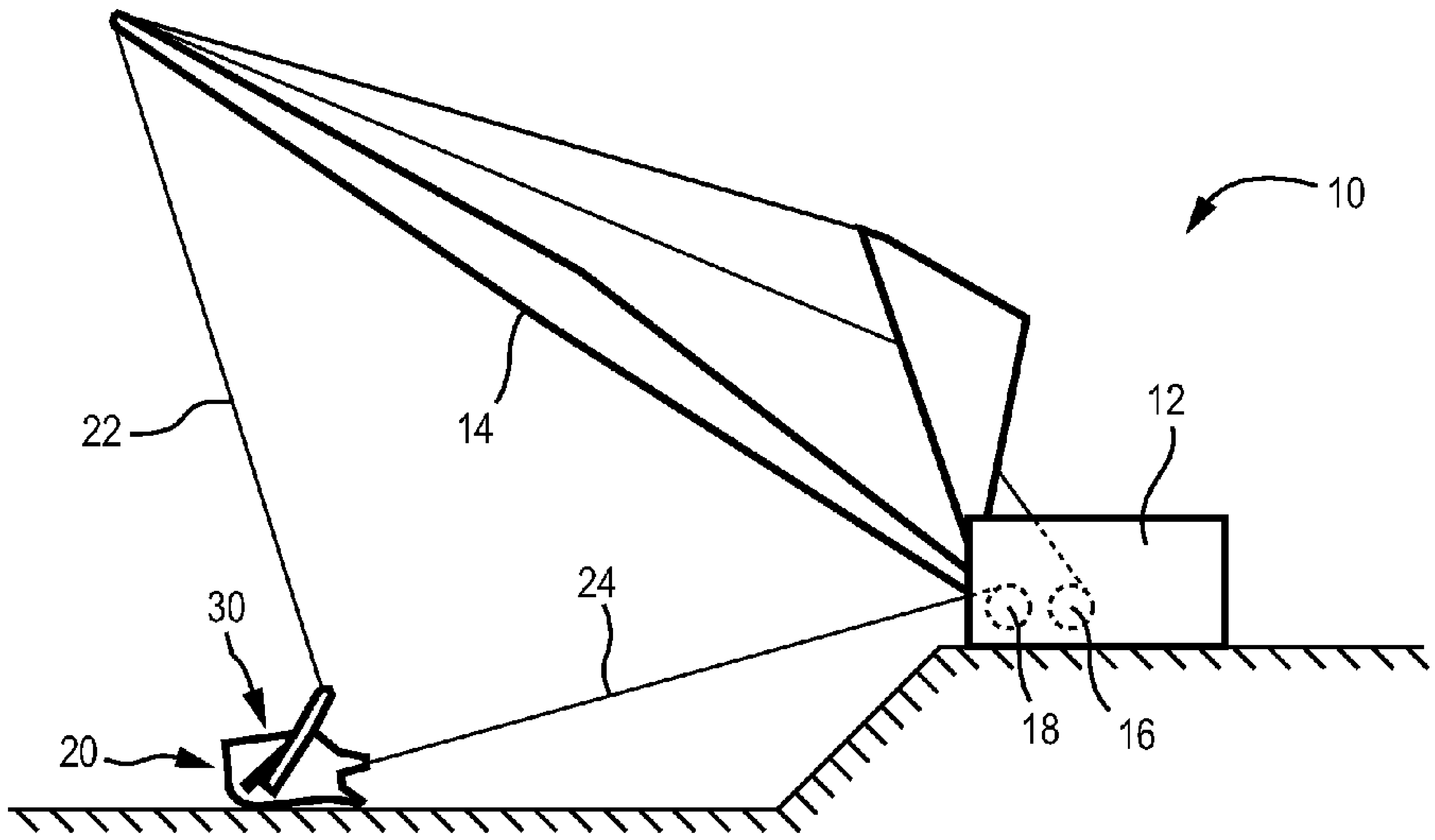


FIG. 1

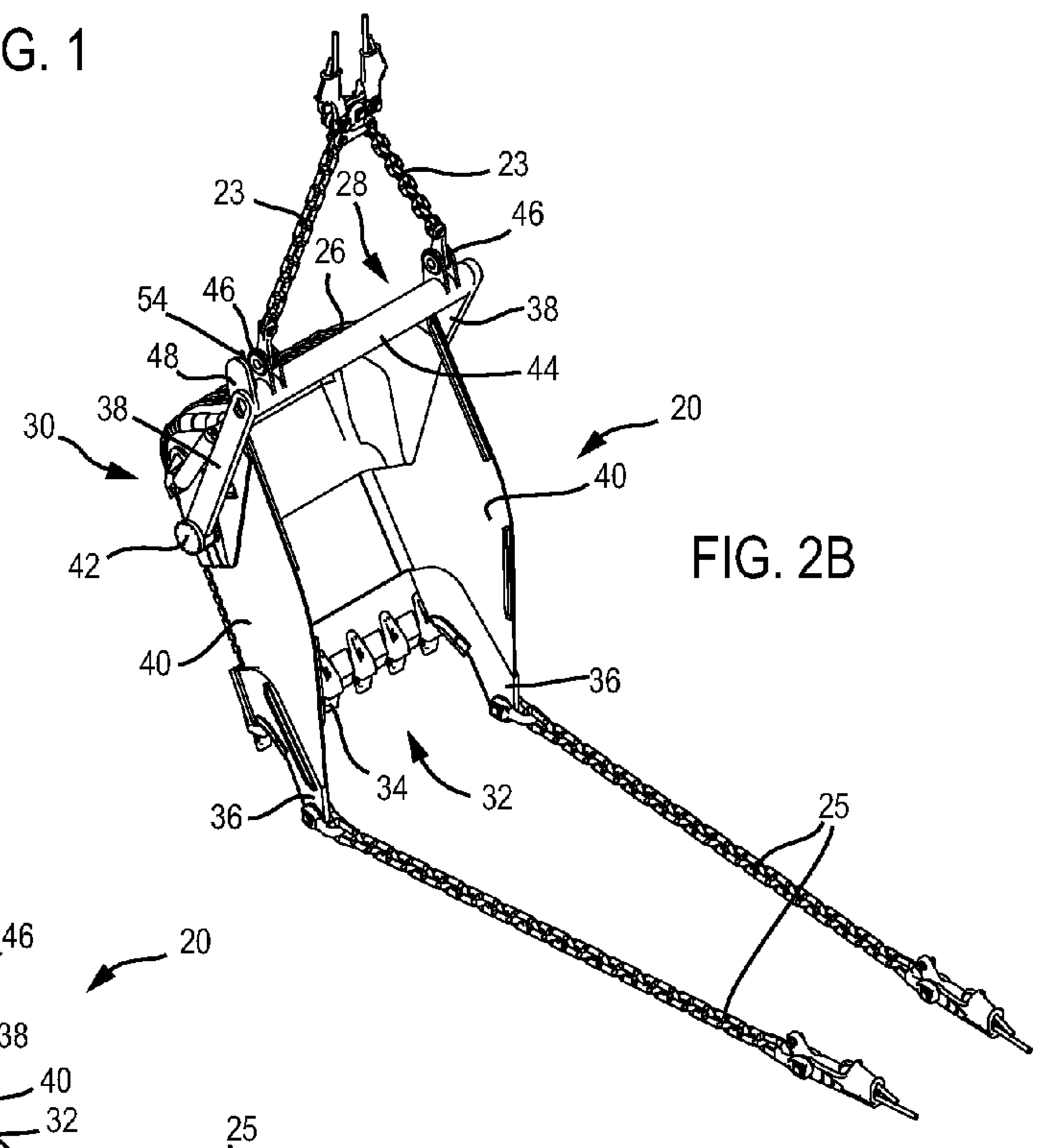


FIG. 2B

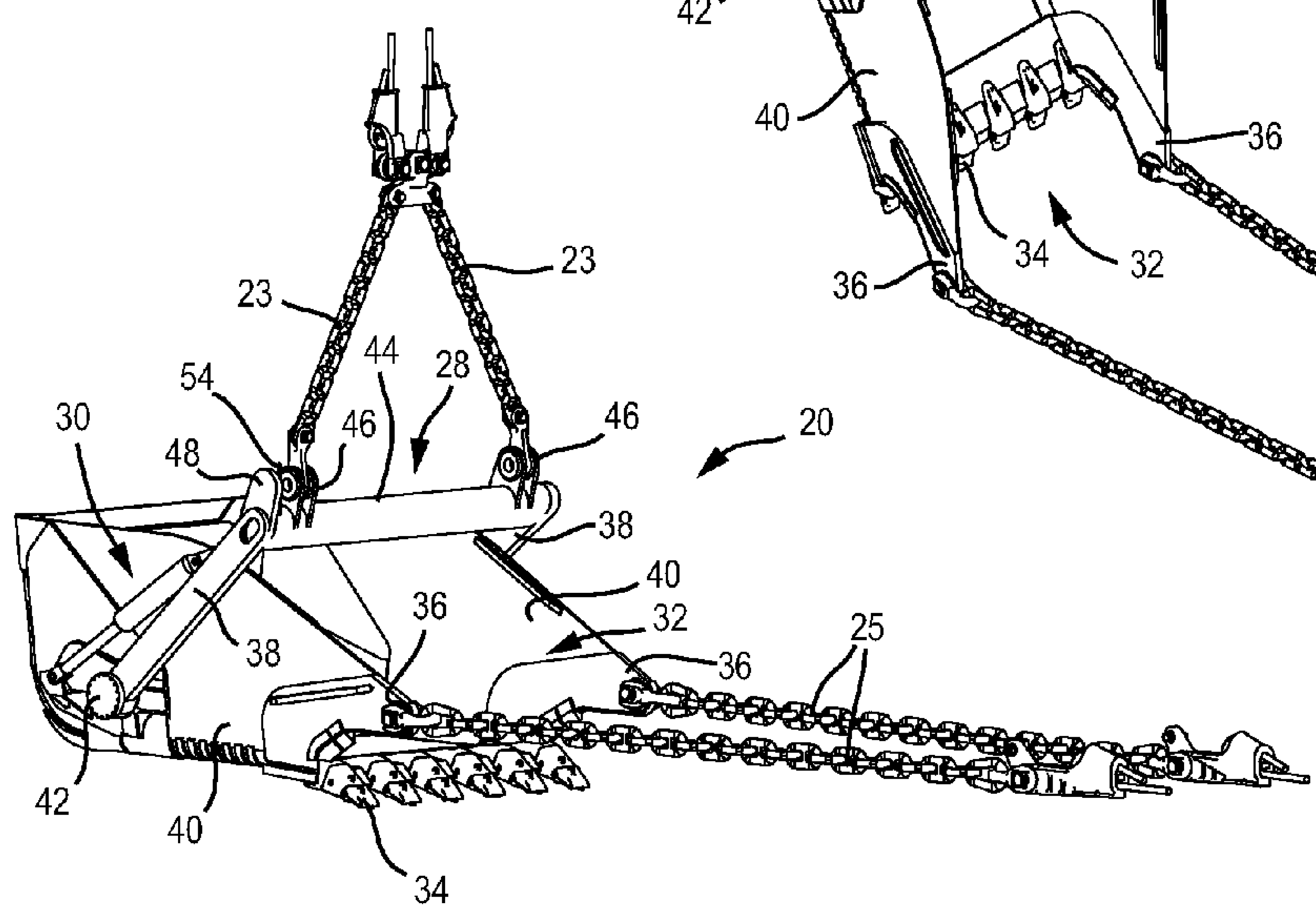


FIG. 2A

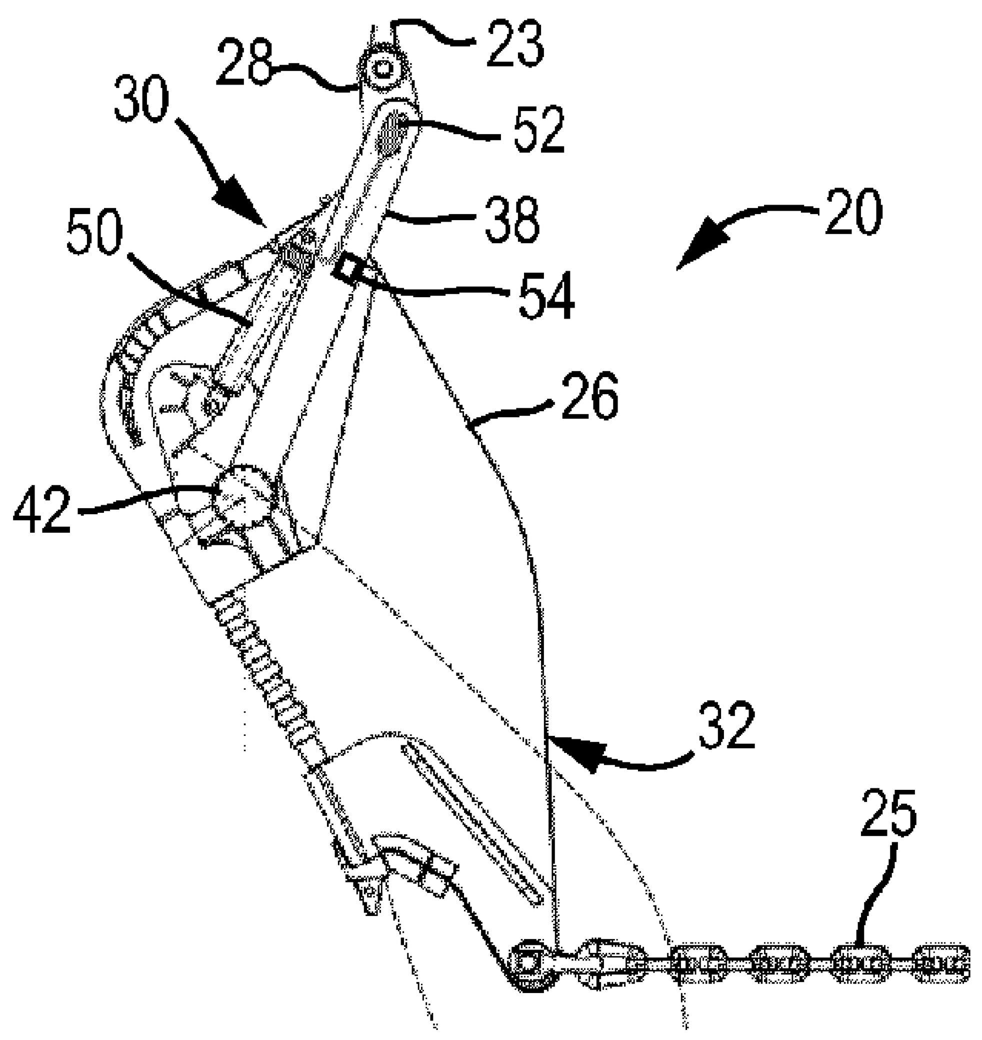


FIG. 3

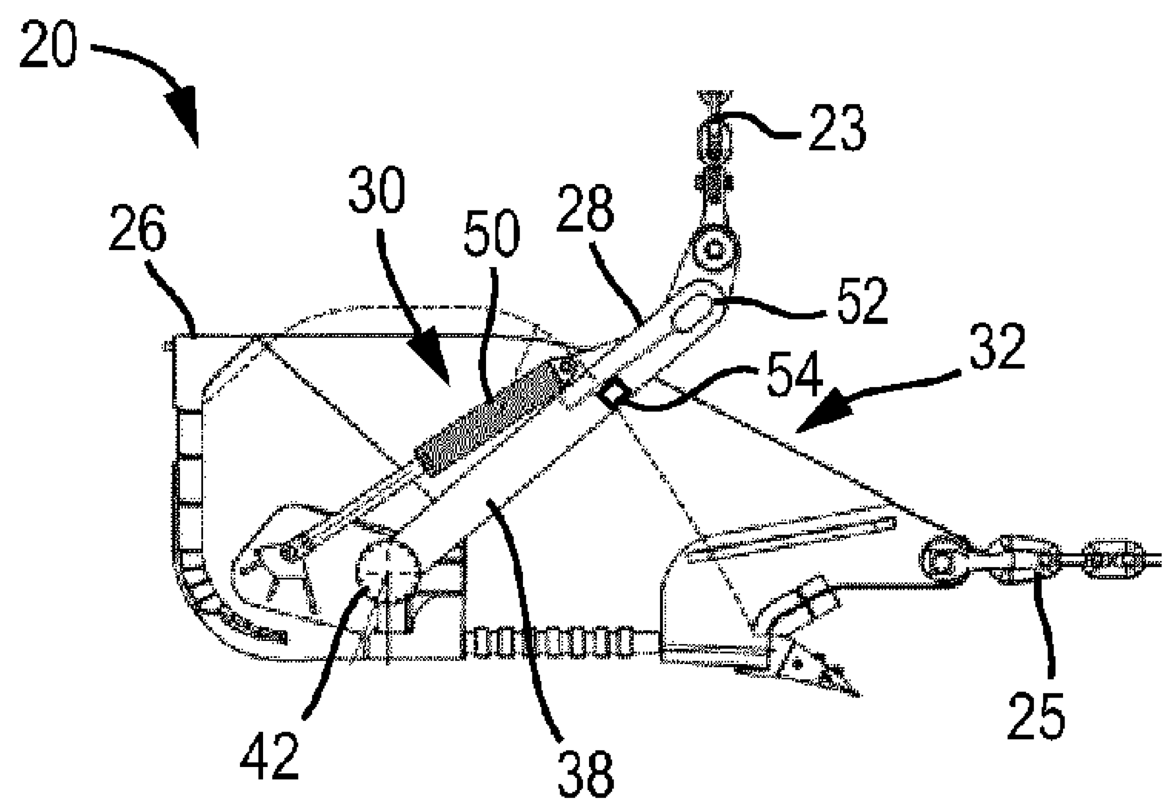


FIG. 4

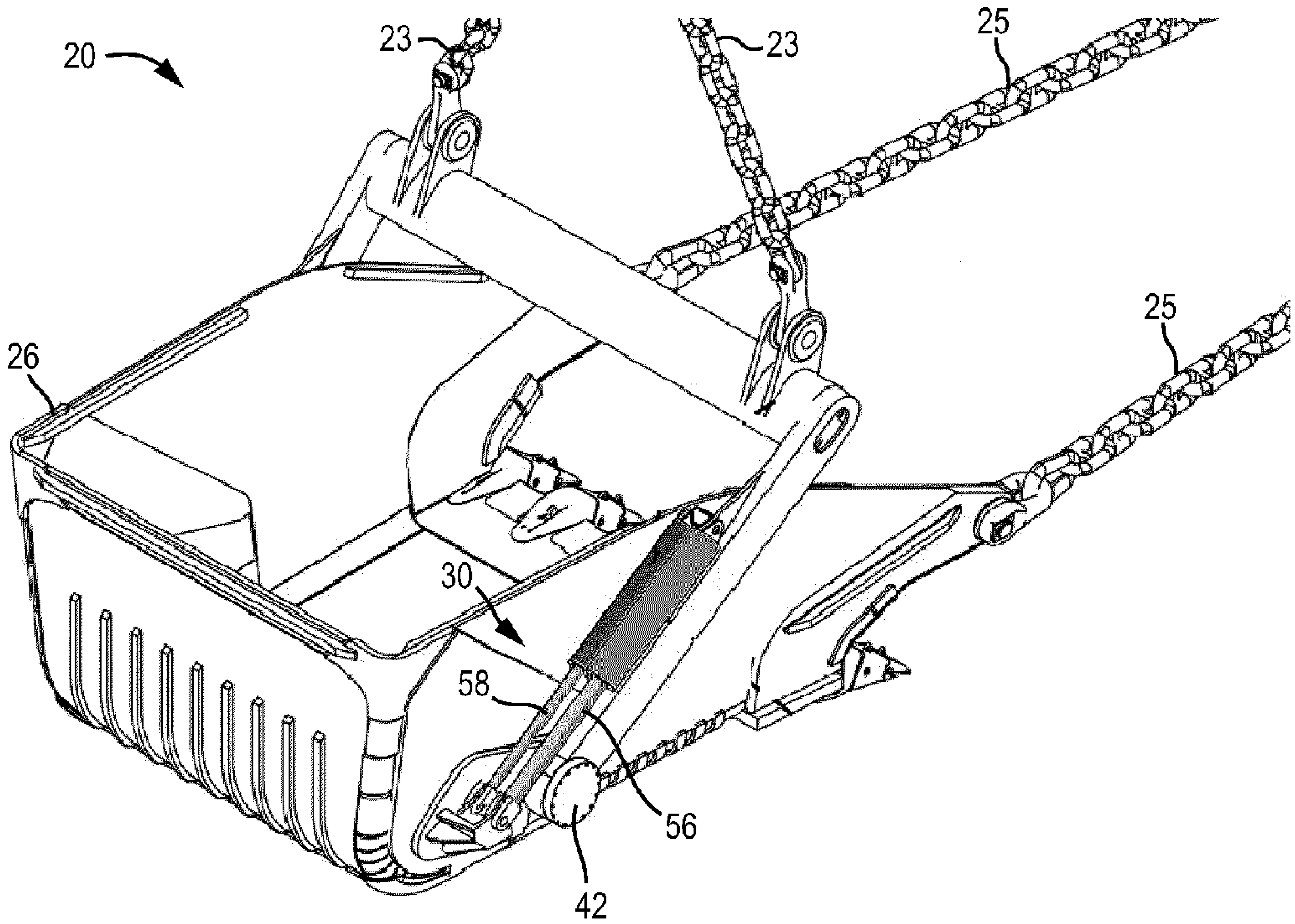
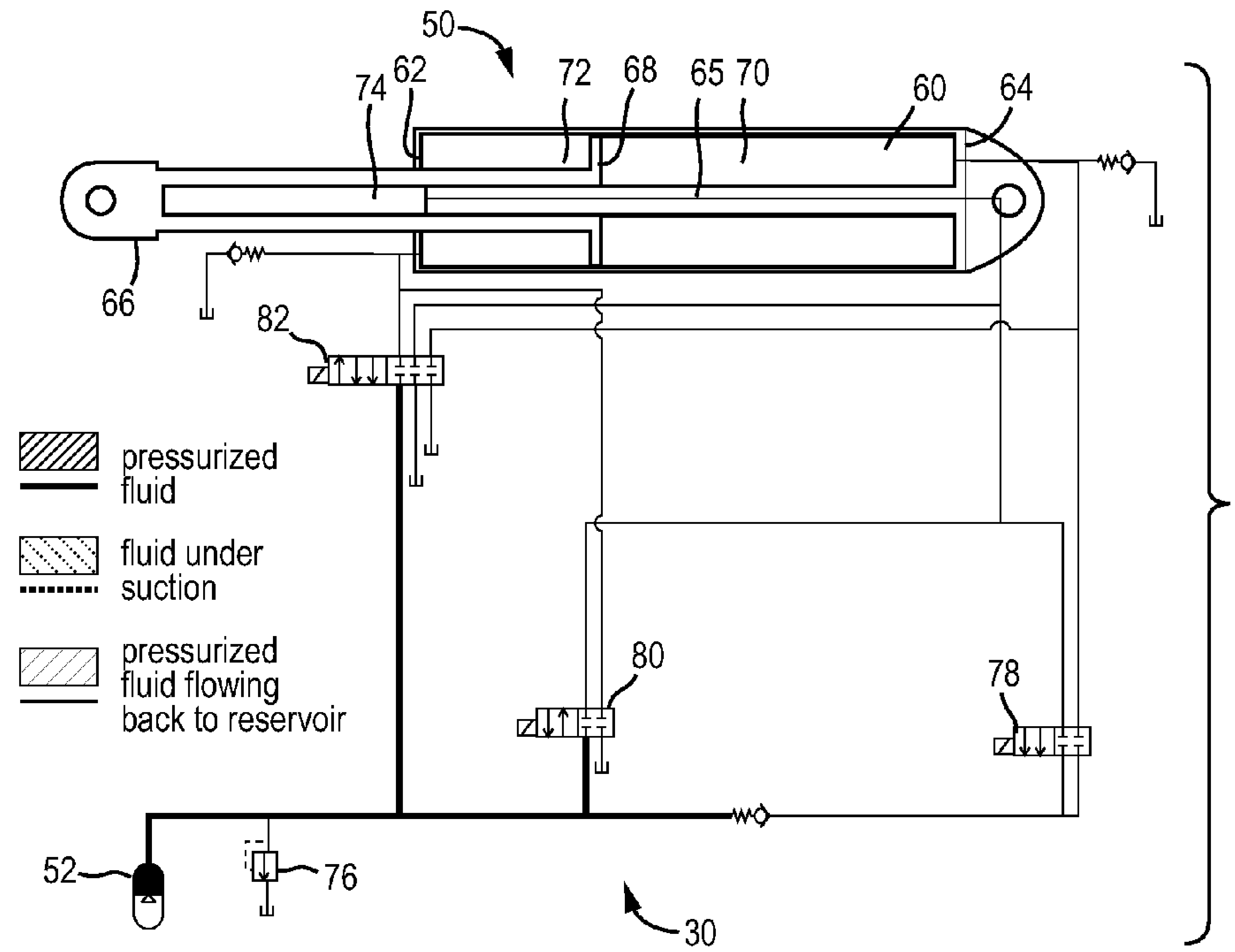
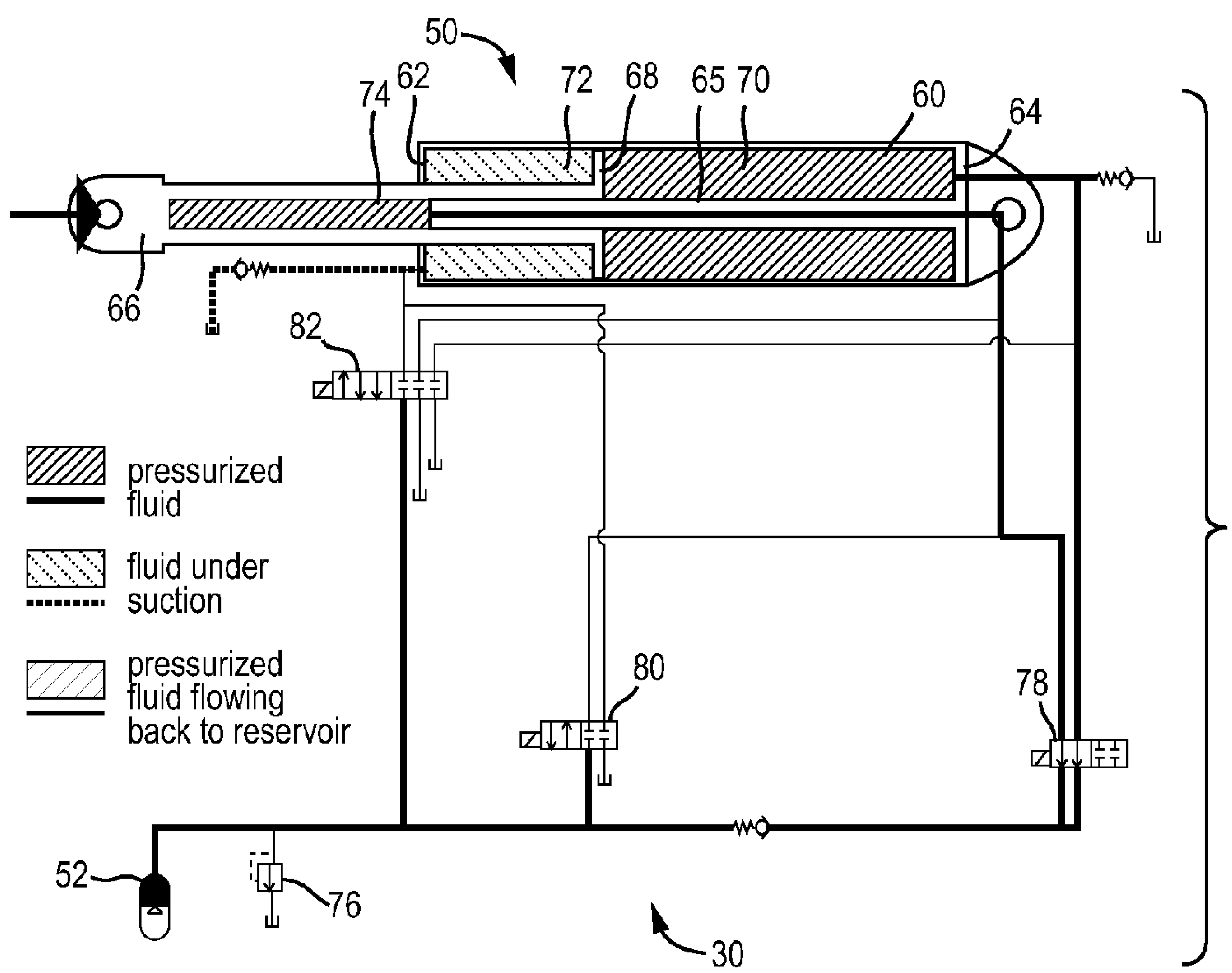


FIG. 5



50
74
62
72
68
65
70
60
64
66
82
pressurized fluid
fluid under suction
pressurized fluid flowing back to reservoir
80
78
52
76
30

FIG. 6



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fluid under suction
pressurized fluid flowing back to reservoir
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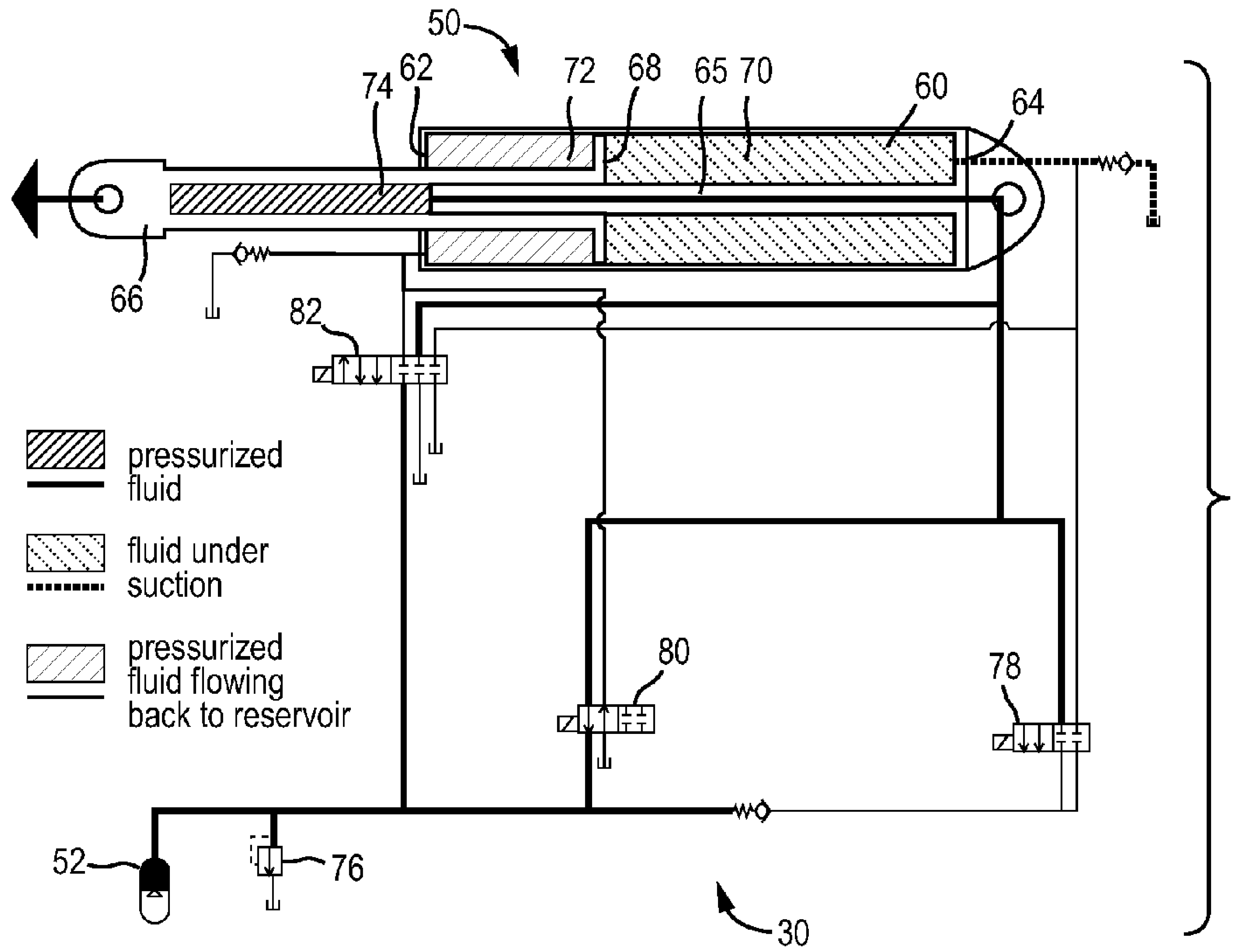
FIG. 7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pressurized fluid
fluid under suction
pressurized fluid flowing back to reservoir
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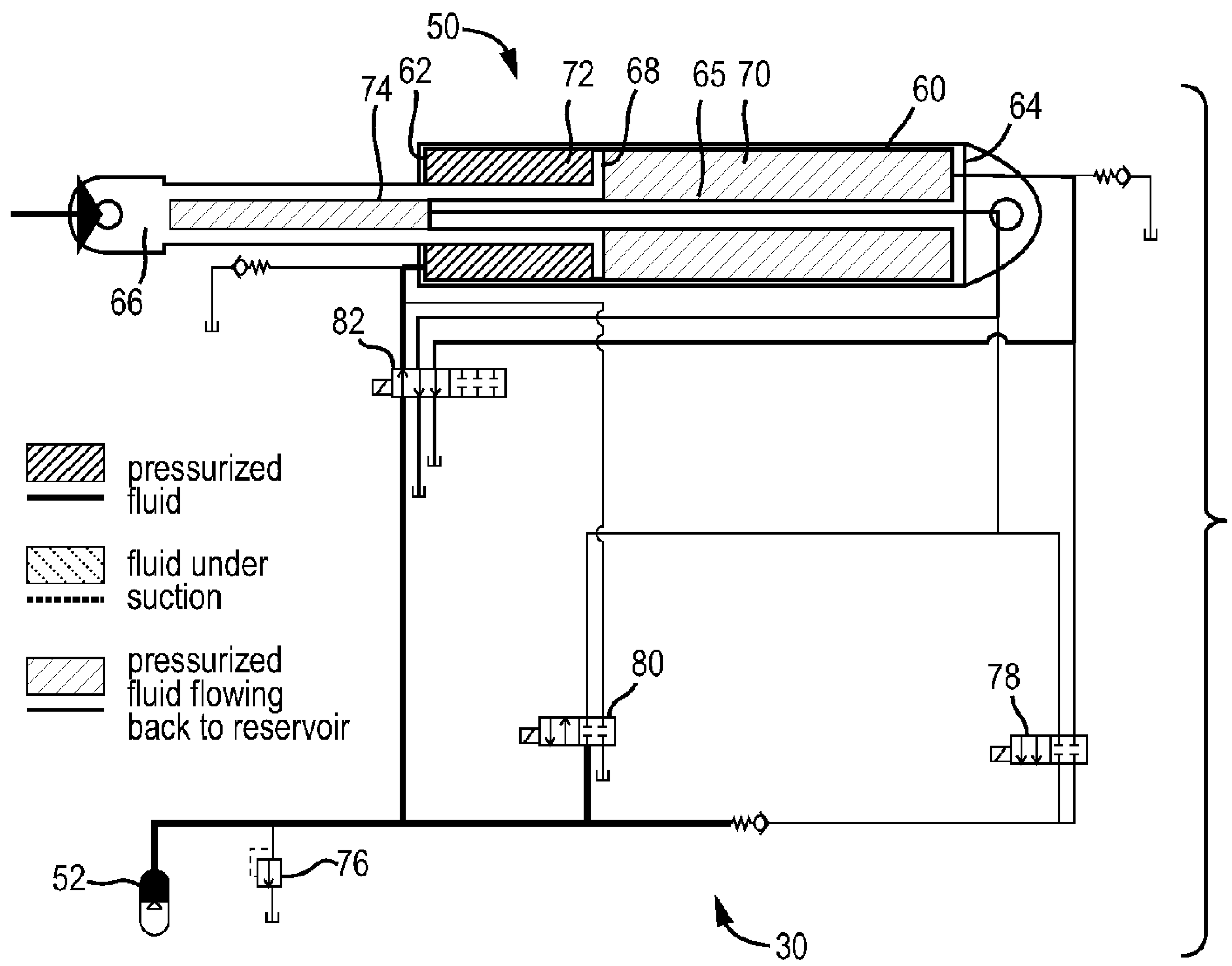
FIG. 8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pressurized fluid
fluid under suction
pressurized fluid flowing back to reservoir
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FIG. 9

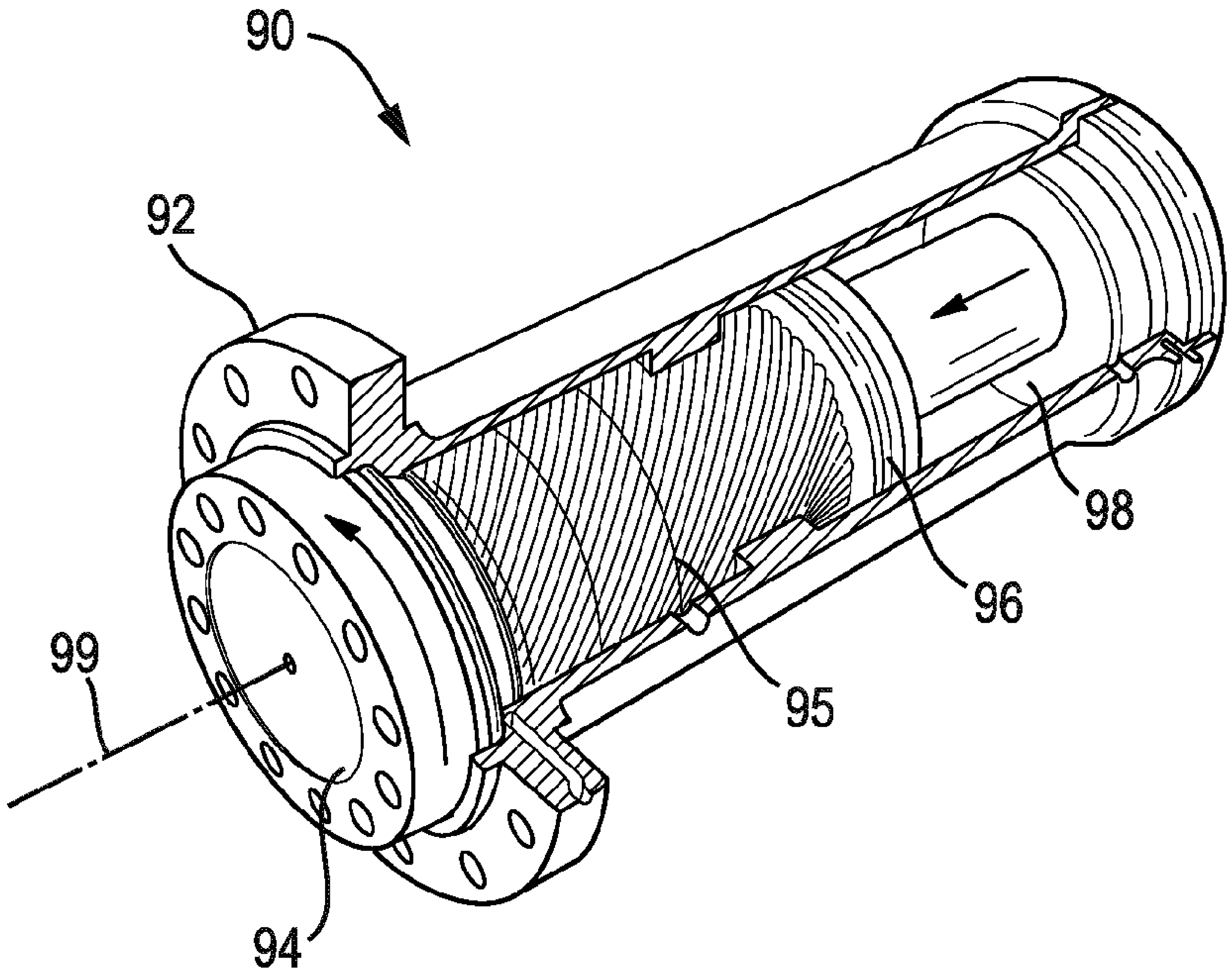


FIG. 10

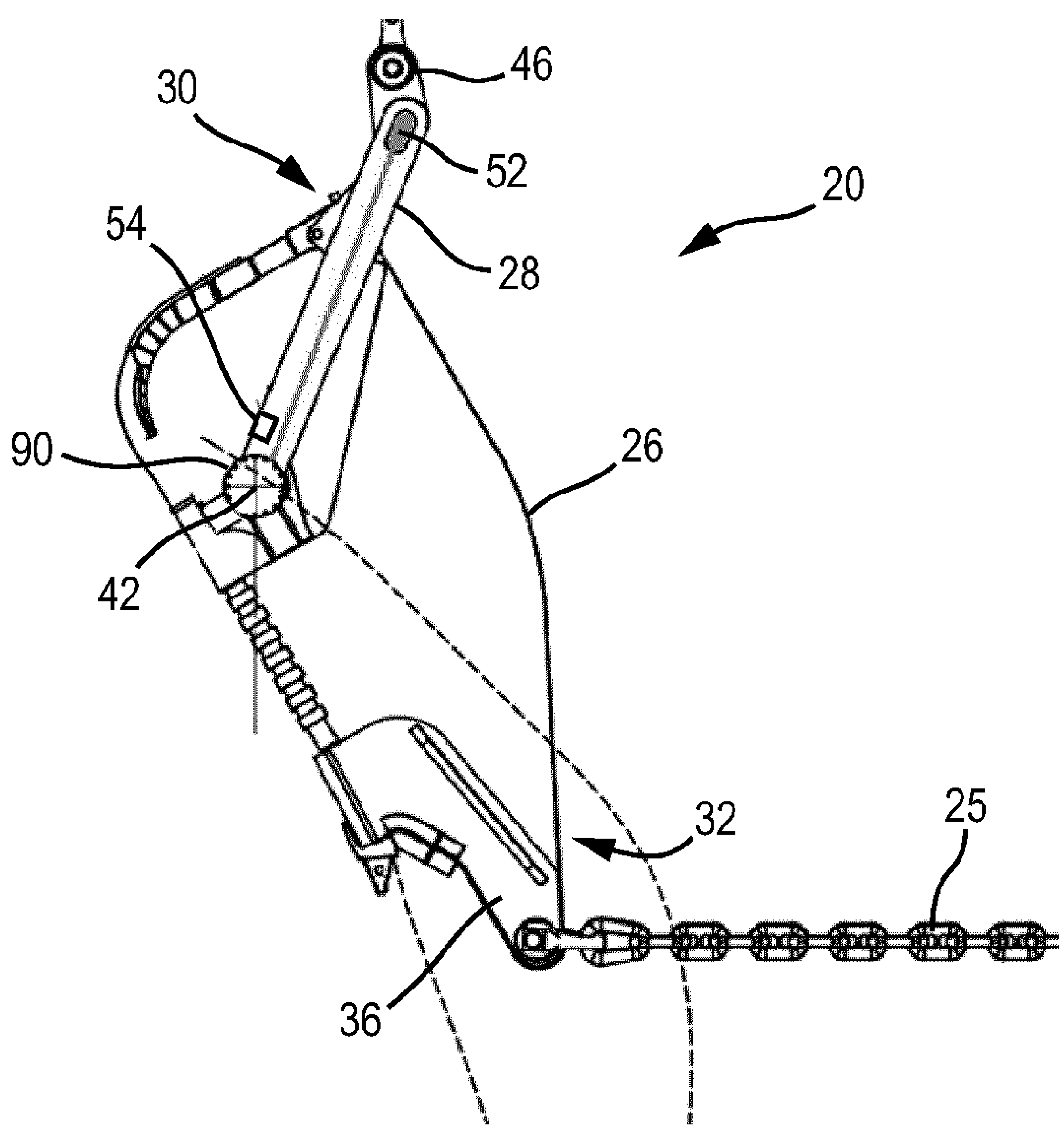
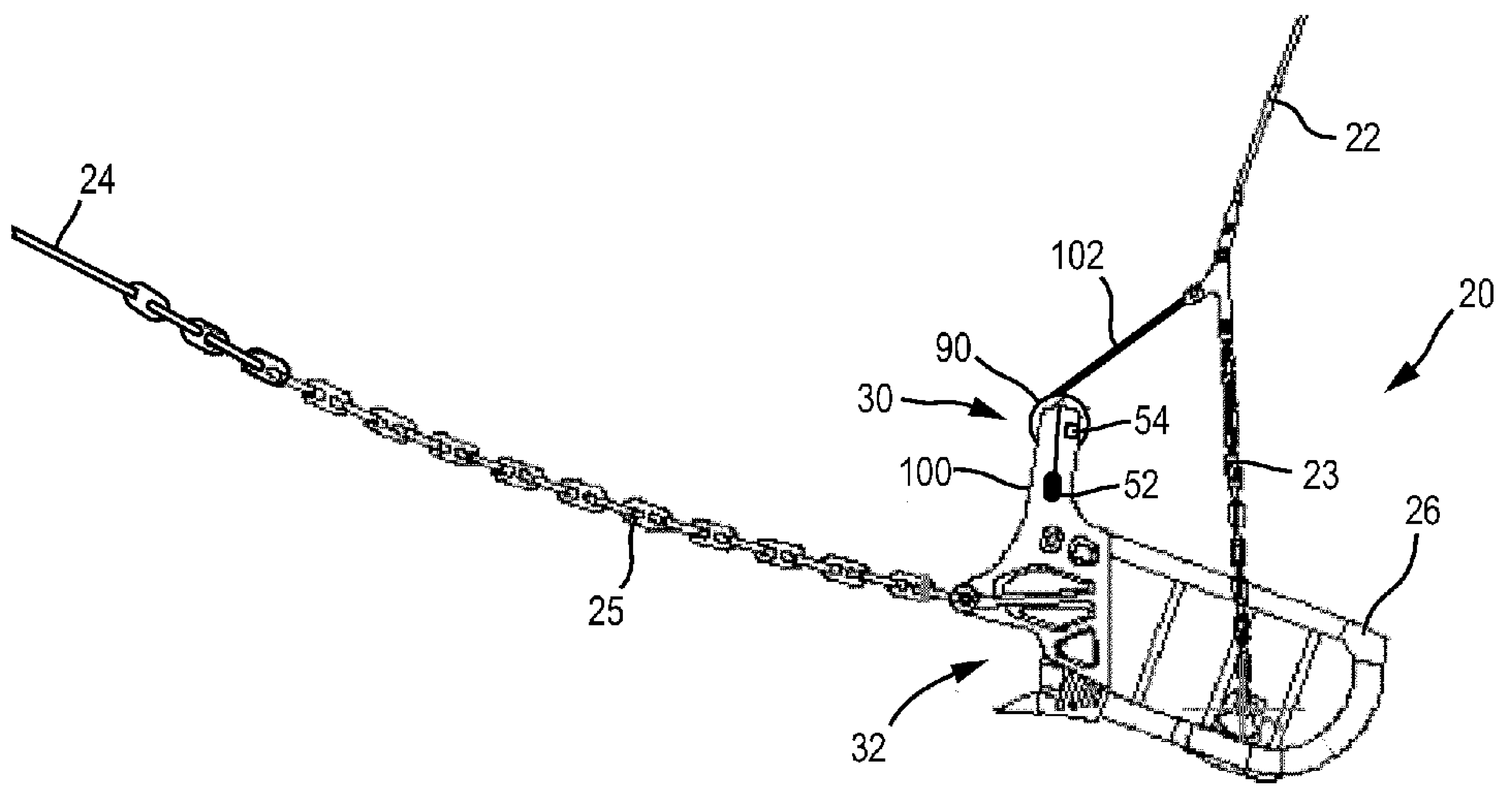


FIG. 11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102
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90
30
54
100
52
23
26
25
32

FIG. 12

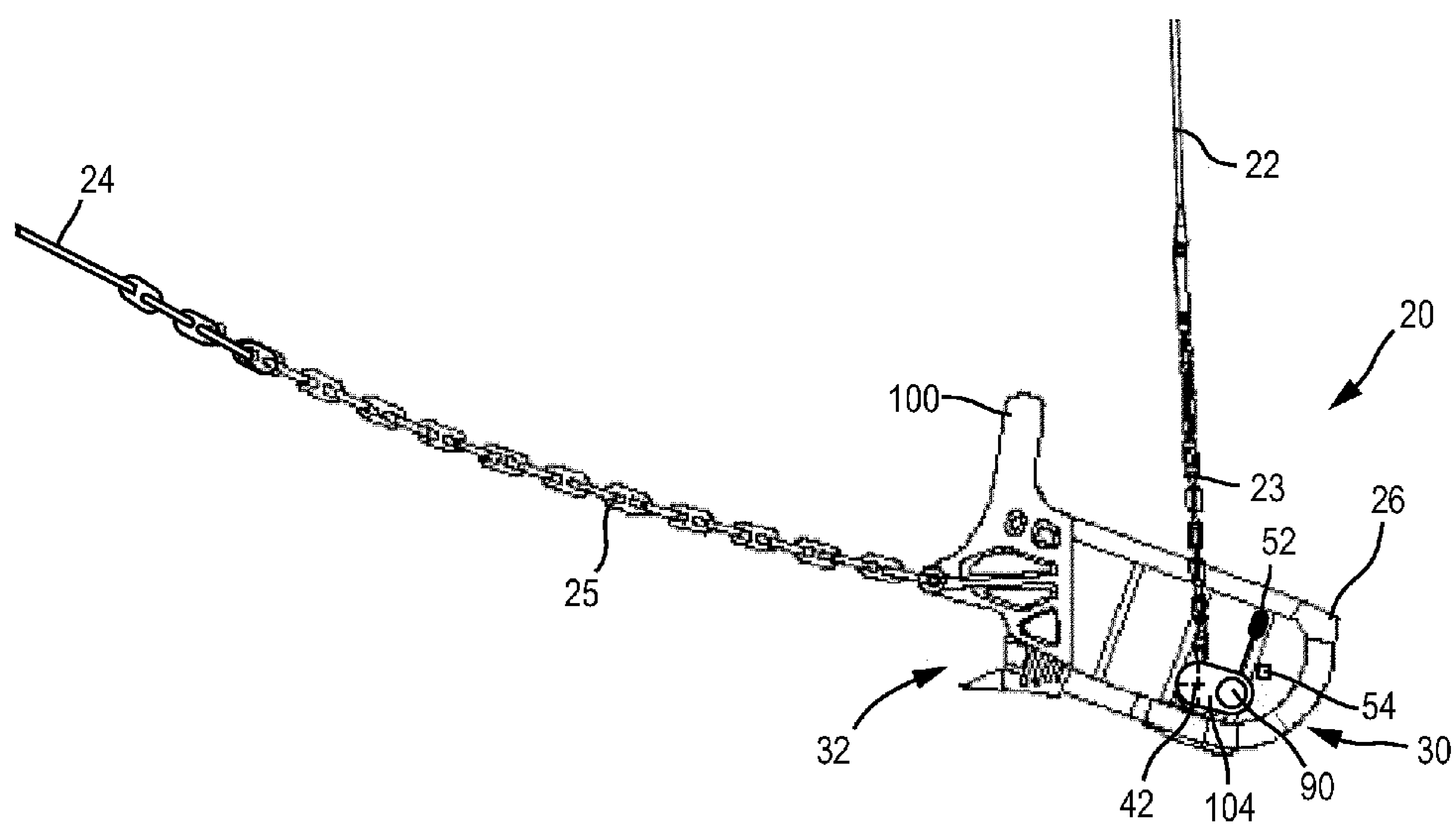
22
24
20
100
23
26
52
25
54
32
30
42
104
90

FIG. 13

DRAGLINE BUCKET WITH REMOTE DUMPING AND POSITIONING CAPABILITIES

FIELD

This disclosure relates generally to the field of buckets for large mining draglines, and particularly to a self-energized, remote controlled bucket for a dragline.

BACKGROUND

Draglines are utilized in mining operations to strip the overburden (e.g., rocks, soil, etc.) above a seam or deposit of a material such as coal or an ore with a large bucket that is dragged across the ground. The path of the bucket is controlled with hoist ropes and drag ropes. The dumping action for conventional buckets are not directly controlled, but are instead controlled through adjusting the tension of the drag ropes through a dump rope mechanism.

Universal dig dump mechanisms exist which allow the direct control of bucket dumping action through the use of multiple hoist ropes (i.e., hoist ropes coupled to both the front and the rear of the bucket) and alternating the lengths of the hoist ropes. However, such universal dig dump systems are more expensive than a conventional system because of modifications to the boom, the addition of a split hoist drum, and extra motors and gearcases. Further, the alternating of the lengths of the hoist ropes applies alternating loads at the sheaves on the end of the boom, creating potential fatigue loading.

SUMMARY

One embodiment relates to a dragline bucket including a main body moveable between a digging orientation and a dumping orientation and a pivotable spreader beam coupled to the main body at a pivot point. The dragline bucket further includes an energy capture mechanism including an actuator coupled to the main body and the pivotable spreader beam and an energy storage mechanism coupled to the actuator.

Another embodiment relates to a dragline including a housing including hoist machinery and drag machinery, a hoist rope coupled to the hoist machinery, and a drag rope coupled to the drag machinery. The dragline further includes a bucket coupled to the hoist rope and the drag rope, and an energy capture mechanism coupled to the bucket. The bucket is moveable about a pivot point between a digging orientation and a dumping orientation. The energy capture mechanism includes an actuator an energy storage device; and a remote control unit configured to receive control signals from an operator of the dragline to operate the actuator. The actuator stores energy in the energy storage mechanism as the bucket moves from the digging orientation to the dumping orientation. The stored energy may be utilized to operate the actuator to position the bucket in the digging orientation.

Another embodiment relates to a method for manufacturing a dragline bucket. The method includes coupling a spreader beam to a bucket at a pivot point; coupling an actuator to the spreader beam and the bucket; and coupling an energy storage device to the actuator. The method further includes providing control valves configured to transfer energy from the actuator to the energy storage device as the bucket moves from a digging orientation to a dumping orientation and to transfer energy from the energy storage device to the actuator to move the bucket from the dumping orientation to the digging orientation.

Alternative exemplary embodiments relate to other features and combinations of features as may be generally recited in the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The disclosure will become more fully understood from the following detailed description, taken in conjunction with the accompanying figures, wherein like reference numerals refer to like elements, in which:

FIG. **1** is a schematic side view of a dragline including a bucket, in accordance with an exemplary embodiment.

FIGS. **2**A and **2**B are perspective views of a bucket for a dragline including an energy capture mechanism, in accordance with an exemplary embodiment.

FIG. **3** is a side view of the bucket of FIG. **2**B in a first or dumping position.

FIG. **4** is a side view of the bucket of FIG. **2**A in a second or digging position.

FIG. **5** is a perspective view of the bucket of FIG. **2**A with an energy capture mechanism including two linear actuators, in accordance with an exemplary embodiment.

FIG. **6** is a schematic diagram of a hydraulic circuit for an energy capture mechanism utilizing a three-phase linear actuator in a neutral mode, in accordance with an exemplary embodiment.

FIG. **7** is a schematic diagram of the hydraulic circuit of FIG. **6** in a dumping mode, in accordance with an exemplary embodiment.

FIG. **8** is a schematic diagram of the hydraulic circuit of FIG. **6** in an up tilt mode, in accordance with an exemplary embodiment.

FIG. **9** is a schematic diagram of the hydraulic circuit of FIG. **6** in a down tilt mode, in accordance with an exemplary embodiment.

FIG. **10** is a partial cutaway perspective view of a helical hydraulic rotary actuator, in accordance with an exemplary embodiment.

FIG. **11** is a schematic side view of the bucket of FIG. **2** with a rotary actuator provided at the pivot point, in accordance with an exemplary embodiment.

FIG. **12** is a schematic side view of a conventional dragline bucket with a rotary actuator provided on the bucket arch in accordance with an exemplary embodiment.

FIG. **13** is a schematic side view of a conventional dragline bucket with a rotary actuator provided offset from the pivot point, in accordance with an exemplary embodiment.

DETAILED DESCRIPTION

Before turning to the figures, which illustrate the exemplary embodiments in detail, it should be understood that the present application is not limited to the details or methodology set forth in the description or illustrated in the figures. It should also be understood that the terminology is for the purpose of description only and should not be regarded as limiting.

Referring to FIG. **1**, a dragline **10** is shown schematically according to an exemplary embodiment. The dragline **10** is configured to remove material (e.g., overburden) with a bucket **20**. The bucket **20** is manipulated utilizing hoist machinery **16** and drag machinery **18** in a housing **12**. The hoist machinery **16** is coupled to the bucket with a hoist rope **22** (e.g., cable, etc.) extending from the hoist machinery **16**, over sheaves on the end of a forwardly extending boom **14**, and to the bucket **20**. The drag machinery **18** is coupled to the bucket **20** with a drag rope **24** (e.g., cable, etc.). The hoist machinery **16** and the drag machinery **18** are controlled by an operator in a machine cabin located in the dragline housing **12**.

Referring to FIGS. **2A-2B**, the bucket **20** includes a main body **26**, a spreader beam **28**, and an energy capture mechanism **30**. The main body **26** is shown as a box-like structure with an open top and an open front end **32**. The open front end **32** of the body **26** may include replaceable teeth **34**. The drag rope **24** is connected to forwardly extending mounting lugs **36** with splayed drag chains **25**, sometimes referred to as drag "jewelry". The spreader beam **28** includes two arms **38** that are pivotably coupled to the side walls **40** of the body **26** at pivot points **42**. The arms **38** are coupled together by a cross-member **44** to form a U-shaped member. The hoist rope **22** is connected to upwardly extending lugs **46** on the cross-member **44** with splayed hoist chains **23**, sometimes referred to as hoist "jewelry".

The bucket **20** is moved along a digging path through the taking up and paying out of the hoist ropes **22** and the drag ropes **24** by the hoist machinery **16** and the drag machinery **18**, respectively. The housing **12** and the boom **14** are first rotated to align the bucket **20** with the material to be removed. The hoist rope **22** and the drag rope **24** are slackened (i.e., payed out) to lower the bucket **20** to the ground. The bucket **20** is then drawn across the ground towards the housing **12** by taking up the drag rope **24** with the digging depth of the bucket **20** is maintained by controlling the tension of the hoist rope **22**. As the bucket **20** is pulled towards the housing **12**, it is filled with material through the open front end **32**. Once the bucket **20** has been filled, it is lifted from the ground by taking up the hoist rope **22** and maneuvered to a dump location in which to empty the bucket **20**. The bucket **20** is emptied by actuating a valve (e.g., dump valve **78** shown in FIG. **7**), allowing the weight of the bucket **20** (and the material payload within the bucket **20**) to rotate the open front end **32** of the bucket **20** downward to empty the material from the bucket **20**.

Referring now to FIGS. **3-4**, the crowd movement (e.g., rotation or tilt) of the bucket **20** is remote controlled from the machine cabin, but powered by stored energy onboard the bucket **20** with the energy capture mechanism **30**. According to an exemplary embodiment, the energy capture mechanism **30** is an electric over hydraulic system with electric solenoids controlling hydraulic valves. The incompressibility of the fluid in a hydraulic system gives the energy capture mechanism an enhanced holding ability. The energy stored onboard the bucket **20** by the energy capture mechanism **30** is continually recharged through an energy storage mechanism by the movement of the dragline bucket **20**. For example, as the bucket **20** moves (e.g., falls; rotates, etc.) into a dumping position, thus emptying the collected material out of the open end **32** (see FIG. **3**), the weight of the material payload compresses hydraulic fluid from an actuator **50** into the energy storage mechanism, shown by way of example as an accumulator **52**. In one exemplary embodiment, the accumulator **52** may be provided within the spreader beam **28**. In other embodiments, the accumulator may be provided elsewhere, such as coupled to the outside of the spreader beam **28** or to the side of the bucket **20**. This compressed fluid may be utilized later in the digging cycle to operate the actuator **50** and adjust the now empty bucket **20** into position for the next digging pass (see FIG. **4**). The energy capture mechanism **30** receives control signals remotely from the operator with a wireless receiver **54** that is powered by a replaceable on-board energy source (e.g., a replaceable battery) or a rechargeable on-board energy source (e.g., a generator driven by the flow of oil). In one exemplary embodiment, the wireless receiver **54** is provided on the spreader beam **28**, next to one of the hoist lugs **46**. A protective lug or shield **48** may be provided on the other side of the wireless receiver **54** to guard the receiver **54** from debris. In other embodiments, the wireless receiver may be coupled to other internal or external locations on the bucket **20** (e.g., within the spreader beam **28**).

While the energy capture mechanism will be described in detail in several exemplary embodiments as a hydraulic system, it should be understood that the principles are applicable to other types of energy storage systems as well, such as electrical, pneumatic, or mechanical systems. For example, in other exemplary embodiments the energy storage mechanism may be an electric motor and electrical energy may be stored in a device such as a capacitor or a battery. In other exemplary embodiments, the energy storage mechanism may be a mechanical linkage and kinetic energy may be stored in a device such as a flywheel.

As shown in FIGS. **3-4**, in one embodiment the actuator **50** is a linear actuator such as a hydraulic cylinder (e.g., hydraulic ram, hydraulic piston, etc.). Linear actuators have good holding ability and efficiency (e.g., a high ratio of energy/fluid capture to energy/fluid use) due to positive displacement operation. With such a positive displacement actuator, all the hydraulic fluid is captured in the accumulator when the bucket dumps. If a single conventional double acting actuator is utilized on either side of the bucket, the applicant believes that enough energy is stored in the dumping motion by the pressurized fluid in the accumulator to bring the bucket back into position (e.g., into the digging orientation). The applicant believes that a single conventional actuator stores more energy in the pressurized fluid during compression (e.g., during a dumping operation of a fully loaded bucket) than is used during extension (e.g., to bring the bucket back into position). However, the actuator cannot utilize a lesser volume of the pressurized fluid to extend the actuator than was forced out when the actuator was compressed. A certain amount of energy is therefore wasted with a single conventional actuator.

Referring now to FIG. **5**, according to another exemplary embodiment, instead of a single conventional actuator on either side of the bucket **20**, the energy capture mechanism may utilize multiple actuators on either side of the bucket **20**, such as a large bore linear actuator **56** and a small bore linear actuator **58**. The use of multiple actuators **56** and **58** on either side of the bucket **20** allows the energy stored in the energy capture mechanism **30** to be utilized to raise the bucket **20** back into a digging position, but also to reposition the bucket **20** one or more times for the next digging pass. Both the large bore actuators **56** and the small bore actuators **58** are used to hold the bucket **20** in the generally horizontal digging orientation. As the bucket **20** is emptied, the spreader beam **28** rotates about the pivot points **42**, compressing both actuators **56** and **58**. The compressed fluid from both actuators **56** and **58** are captured in an energy storage mechanism. According to one embodiment, only the small bore actuators **58** are extended to actuate the movement of the empty bucket **20** back into the digging position, requiring less volume than would be used to extend both the large actuators **56** and the small actuators **58** and allowing for several adjustments to be potentially made to the crowd position of the bucket **20**. As the bucket **20** is repositioned by the small bore actuators **58**, the large bore actuators **56** are also extended, drawing fluid from the reservoir to be captured at the next dump.

Referring now to FIGS. **6-9**, according to another exemplary embodiment, the actuator **50** may be a triple acting actuator. The triple acting actuator **50** has multiple interior chambers that can be pressurized in different combinations, allowing the actuator to operate as a variable force and variable speed actuator. When the load is small the actuator **50** can move (i.e. extend or contract) quickly with little force and as the load increases, the actuator **50** can change to move with increased force and decreased speed. As shown in FIG. **6**, in one embodiment the actuator **50** includes a hollow barrel or cylinder **60** closed by a cylinder base **62** and a cylinder head **64**. A piston rod **66** is coupled to a piston **68**, which is moveable in the cylinder **60** and separates the interior of the cylinder **60** into a primary chamber **70** and a return chamber **72**. The piston rod **66** is a hollow member forming a secondary chamber **74** that receives a secondary rod **65** coupled to the cylinder head **64**. The primary chamber **70**, the return chamber **72**, and the secondary chamber **74** are in fluid communication with each other, an accumulator **52** and a fluid reservoir through a hydraulic circuit. The triple acting actuator **50** is analogous to the paired large bore actuator **56** and small bore actuator **58** described above. The large actuator formed by the piston **68** and the cylinder **60** is configured to support the high load of the bucket **20** and is responsible for most of the fluid being charged into the accumulator **52** when dumping. The smaller actuator formed by the secondary rod **65** and the hollow piston rod **66** cylinder is used primarily for maneuvering the empty bucket **20** into position.

The following is a stepped through example of a digging and dumping cycle for a bucket **20** equipped with an energy capture mechanism **30** with a triple acting actuator **50**.

After fitting the bucket **20** to the drag rope **24** and the hoist rope **22**, the actuator **50** is balanced and unpressurized and the accumulator **52** is charged (see FIG. **6**). The bucket **20** is dragged along the ground to gather material with the spreader beam **28** resting fully forward, as shown in FIG. **4**. At the end of the digging pass, the hoist rope **22** is taken up by the hoist machinery **16**, lifting up on the spreader beam **28**. As the spreader beam **28** pivots back on the pivots **42** (automatically or manually), pressurized fluid flows past a dump valve **78** charging the accumulator **52**. Once the required balance/angle of the bucket **20** is reached, the dump valve **78** closes, allowing the loaded bucket **20** to lift from the ground.

This process of "pumping" the hydraulic fluid with the spreader beam **28** may occur at start up (e.g., before digging) to charge the accumulator **52** by lifting and lowering the hoist rope **22** while the bucket **20** is on the ground to cycle the spreader beam **28** between a forward position and a rearward position. According to an exemplary embodiment, the accumulator **52** may be charged when the bucket **20** is empty.

Once the bucket **20** is off the ground, the energy capture mechanism **30** allows the bucket **20** to be positioned and dumped wherever the operator wishes (see FIG. **7**). When the bucket **20** is in the desired dumping position, the dump valve **78** is released. With the dump valve **78** released, pressurized fluid is forced out of both the primary chamber **70** and the secondary chamber **74** and fluid is drawn into the return chamber **72**, contracting the actuator **50**. The contraction of the actuator **50** allows the spreader beam **28** to rotate backwards and the bucket **20** to tilt down under the weight of the payload, dumping the load out of the open front end **32**, as shown in FIG. **3**. As the bucket **20** tilts downward, the bulk of the high pressure fluid is forced through the energy capture mechanism **30** into the accumulator **52**. A pressure relief valve **76** allows excess fluid to bypass the accumulator **52** to the reservoir if the accumulator **52** becomes overcharged.

The energy stored in the energy capture mechanism may be utilized to position the bucket **20** to a desired angle for the next digging pass. Once the bucket **20** is dumped, according to an exemplary embodiment, the center of gravity of the bucket **20** is at or near the pivot point **42** of the spreader beam **28** such that minimum pressure is required to tilt the bucket **20** into a desired position. The bucket **20** may be tilted upward by opening the bucket up valve **80**, allowing pressurized fluid from the accumulator **52** to be forced into the secondary chamber **74** of the actuator **50** while forcing fluid back out of the return chamber **72** and causing the actuator **50** to extend (see FIG. **8**). The bucket **20** may be tilted downward by opening the bucket down valve **82**, allowing pressurized fluid from the accumulator **52** to be forced into the return chamber **72** of the actuator **50** while forcing fluid out of the primary chamber **70** and the secondary chamber **74** and causing the actuator to contract (see FIG. **9**). Because the extension of the actuator **50** is achieved by the small bore actuator formed by the secondary rod **65** and the hollow piston rod **66**, less stored energy is used than would be used to reposition the bucket **20** using the large bore actuator formed by the piston **68** and the cylinder **60**.

Tilting the bucket **20** back and forth excessively between dumping will expel all the energy stored in the energy capture mechanism **30**. However, if operated efficiently, the bucket **20** can be positioned between digging passes without any external energy input, using only energy stored in the energy capture mechanism **30**.

While the energy capture mechanism **30** has been described as utilizing a linear actuator, in other embodiments, the energy capture mechanism may utilize another type of actuator to store energy as the bucket **20** is selectively dumped and use that energy to reposition the bucket **20**. According to another exemplary embodiment, the actuator may be a rotary actuator **90**, shown in FIG. **10** as a helical, hydraulic L30 rotary actuator as sold by the Helac Corporation. The rotary actuator **90** includes an outer portion **92**, an inner portion **94** coaxial with and rotatable relative to the outer portion **92**, and a piston **96** received in the outer portion **92**. The piston **96** defines an interior chamber **98** in outer portion **92**. The piston **96** translates along the rotational axis **99** of the inner portion **94** and the outer portion **92** in response to the addition or removal of hydraulic fluid from the chamber **98**. The inner portion **94** engages the piston **96** with a helical gear interface **95** such that a linear movement of the piston **96** corresponds to a rotational movement of the inner portion **94** relative to the outer portion **92**. Such rotary actuators **90** can rotate up to 360 degrees. Rotary actuators **90** as shown in FIG. **10** are relatively strong, and typically have a holding ability comparable to a linear hydraulic actuator.

Referring now to FIG. **11**, the energy capture mechanism **30** may include a rotary actuator **90** aligned with the pivot point **42** of the pivotable spreader beam **28**. The actuator **90** is coupled between the spreader beam **28** and the main body **26** of the bucket **20** (e.g., with the outer portion **92** coupled to the main body **26** and the inner portion **94** coupled to the spreader beam **28**). As the bucket **20** moves into a dumping position, emptying the collected material out of the open end **32**, the weight of the material payload rotates the inner portion **94** relative to the outer portion **92**. The rotation of the inner portion **94** moves the piston **96** along the axis **99** and compresses hydraulic fluid from the actuator **50** into the accumulator **52**. This compressed fluid may be utilized later in the digging cycle to operate the actuator **50** and adjust the now empty bucket **20** into position for the next digging pass. In addition to capture energy from the dumping operation, a rotary actuator **90** at the pivot point **42** serves as a bearing/bushing to facilitate the rotation of the bucket **20** about the pivot point **42**. Similar to the energy capture mechanism **30** of FIG. **3**, a wireless receiver **54** may receive control signals remotely from the operator to operate that actuator **90**.

Referring now to FIGS. **12-13**, according to another exemplary embodiment, an energy capture mechanism **30** with a rotary actuator **90** may be used on a dragline bucket **20** with a forward arch **100**. As shown according to one exemplary embodiment in FIG. **12**, the rotary actuator **90** with a sheave/reel may be coupled to the arch **100** where the dump rope **102** is coupled to the arch **100**. The dump rope **102** extends from the hoist rope **22** and is taken up on the reel coupled to the rotary actuator **90**. By paying off or taking up the dump rope **102**, the rotation or tilt of the bucket **20** may be controlled by an operator remotely through the receiver **54**. As shown according to another exemplary embodiment in FIG. **13**, the rotary actuator **90** may be coupled to the bucket **20** proximate to the attachment point for the hoist chains **23** (e.g., near the pivot point **42**). The rotary actuator is coupled to the bucket **20** and to the hoist chain **23** via an eccentric cam member **104**. Through the rotation of the actuator **90**, the cam **104** moves the hoist chain **23** to dump the bucket **20**. An existing conventional dragline bucket may be retrofitted with the energy capture mechanism **30** as shown in FIG. **12** or **13** to provide remote bucket control and energy capture functionality without modifications to other components of the dragline, such as the boom **14**, the hoist machinery **16**, or the drag machinery **18**.

The energy capture mechanism as described above in various embodiments allows the dragline bucket to be directly controlled from the cab of the machine, dumping the contents of the bucket at any location along the digging path of the bucket. Further, a bucket utilizing the energy capture mechanism may not require a dump rope and sheaves, thereby reducing the number of components and weight of the bucket. Unlike a universal dig dump mechanism, the energy capture mechanism as described does not require modifications to existing dragline components (e.g., the boom, the hoist drum, the hoist gearcases, ballast, etc.). Because the energy capture mechanism includes only modifications to the bucket and the hoist jewelry, the energy capture mechanism may be relocated from dragline to dragline (i.e., provided on another dragline). Additionally, because the energy capture mechanism does not require multiple hoist ropes coupled to the front and back of the bucket, a bucket utilizing the energy capture mechanism requires reduced maintenance compared to a universal dig dump mechanism.

The construction and arrangements of the bucket assembly, as shown in the various exemplary embodiments, are illustrative only. Although only a few embodiments have been described in detail in this disclosure, many modifications are possible (e.g., variations in sizes, dimensions, structures, shapes and proportions of the various elements, values of parameters, mounting arrangements, use of materials, colors, orientations, etc.) without materially departing from the novel teachings and advantages of the subject matter described herein. Some elements shown as integrally formed may be constructed of multiple parts or elements, the position of elements may be reversed or otherwise varied, and the nature or number of discrete elements or positions may be altered or varied. The order or sequence of any process, logical algorithm, or method steps may be varied or re-sequenced according to alternative embodiments. Other substitutions, modifications, changes and omissions may also be made in the design, operating conditions and arrangement of the various exemplary embodiments without departing from the scope of the present invention.

What is claimed is:

1. A dragline bucket, comprising:

a main body moveable between a digging orientation and a dumping orientation;

a pivotable spreader beam coupled to the main body at a pivot point, wherein the main body is configured to move from the digging orientation to the dumping orientation by rotating downward about the pivot point relative to the pivotable spreader beam in order to empty the contents of the bucket; and

an energy capture mechanism comprising:

an actuator coupled to the main body and the pivotable spreader beam; and

an energy storage device coupled to the actuator, wherein the main body is configured to compress the actuator when the main body moves from the digging orientation to the dumping orientation, causing the actuator to transfer energy to the energy storage device.

2. The dragline bucket of claim **1**, wherein the energy storage device transfers at least some of the stored energy to the actuator in order to move the main body from the dumping orientation to the digging orientation by extending the actuator.

3. The dragline bucket of claim **2**, wherein the energy capture mechanism comprises a hydraulic system.

4. The dragline bucket of claim **3**, wherein the energy storage device comprises a hydraulic accumulator.

5. The dragline bucket of claim **4**, wherein the actuator comprises a small bore linear actuator and a large bore linear actuator, wherein both the small bore linear actuator and the large bore linear actuator are compressed to transfer energy to the energy storage device when the main body moves from the digging orientation to the dumping orientation, and wherein only the small bore linear actuator is extended to actuate movement of the main body from the dumping orientation to the digging orientation.

6. The dragline bucket of claim **4**, wherein the actuator comprises a multiphase linear actuator comprising a first chamber, a second chamber, and a third chamber, the third chamber having a cross-sectional area that is less than the cross-sectional area of the first chamber; wherein a volume of fluid forced into one of the first chamber or the third chamber moves the actuator in a first direction and the volume of fluid forced into the second chamber moves the actuator in an opposite direction.

7. The dragline bucket of claim **6**, wherein the volume of fluid forced into the first chamber moves the actuator at a first speed with a first force and wherein the volume of fluid forced into the third chamber moves the actuator as a second speed with a second force, the first speed being less than the second speed and the first force being greater than the second force.

8. The dragline bucket of claim **4**, wherein the actuator comprises a rotary actuator.

9. The dragline bucket of claim **8**, wherein the rotary actuator is coupled to the pivot point of the pivotable spreader beam.

10. The dragline bucket of claim **1**, wherein the energy capture mechanism receives remote instructions through a remote control unit coupled to the bucket.

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